

EXAM NUMBER _____

**NATS 101, Section 13, Fall 2010
Midterm Examination #2
October 22, 2010**

Name: _____

SID: _____

Instructions:

- Write your name and student ID on ALL pages of the exam.
- In the multiple-choice/fill in the blank section, please fill-in only **ONE** answer. Use the multiple choice scantron answer sheet. Turn this sheet in separately when you hand in your exam. You should also record multiple choice answers next to the question, as scantron sheets will not be returned.
- In the short answer section, please make sure to read each question carefully and show your work where it is required. Should you need more room to answer your questions, you can use the other side, and indicate it with the answer.
- You **CANNOT** use a calculator.
- You are **NOT** allowed to use your book or notes on this exam.
- You are **NOT** allowed to talk about or look at anyone else's exam. If you commit such an offense, you will be awarded a **0** and the offense will be noted in accordance to **The Code of Academic Integrity**.
- Good luck!

Score:

Multiple Choice Section: _____ / 25 points

Short Answer Section: _____ / 15 points

Bonus Questions: _____ / 7 points

Total: _____ / 40 points

Helpful constants

Dry adiabatic lapse rate = 10 °C per km (approximately)

Moist adiabatic lapse rate = 6 °C per km (approximately)

VERSION A

Midterm Examination #2
NATS 101, Section 13, Fall 2010
Introduction to Weather and Climate
Multiple Choice Section

Scoring: Each question is worth 1 point in this section.

1. Which of the following is not a form of precipitation?
 - a) Rain
 - b) Snow
 - c) Fog
 - d) Sleet
 - e) Hail.

2. Which type of cloud would produce hail?
 - a) Cirrus.
 - b) Cirrocumulus.
 - c) Cumulonimbus.
 - d) Nimbostratus.
 - e) All of the above cloud types can produce hail.

3. Which of the following is **not** characteristic of an El Niño event?
 - a) Eastern Pacific sea surface temperatures become colder than normal
 - b) The strength of the trade winds in the Pacific decrease
 - c) There is typically more winter rainfall in Arizona
 - d) Rainfall decreases in Indonesia and Australia.
 - e) None of the above

4. If lenticular clouds are observed downwind of a mountain range an airplane flying in this area would _____.
 - a) Not experience turbulence because these are fair weather clouds.
 - b) Experience turbulence because these clouds indicate rotor circulations.
 - c) Experience turbulence because these are thunderstorm clouds that can produce a microburst.
 - d) Both (b) and (c).
 - e) None of the above.

5. Which of the following cloud types produces widespread and steady light to moderate intensity precipitation?
 - a) Cumulus castellanus
 - b) Nimbostratus
 - c) Cumulonimbus
 - d) Cirrocumulus
 - e) None of the above

6. With respect to lines of constant surface pressure, or isobars, surface winds will tend to blow _____.
 - a) Exactly perpendicular to the isobars towards low pressure
 - b) Exactly perpendicular to the isobars towards high pressure
 - c) Exactly parallel to the isobars
 - d) Nearly parallel to the isobars, but curved slightly towards low pressure
 - e) Nearly parallel to the isobars, but curved slightly towards high pressure

VERSION A

7. A Chinook wind _____.
- a) Melts snow because it is warm
 - b) Freezes crops because it is cold
 - c) Forms because high altitude air radiates energy to space
 - d) Is typically found upwind of mountain ranges
 - e) None of the above
8. If the surface temperature is 18°C and a parcel of air from the surface is lifted 1 km to the lifting condensation level, what will the final temperature of the parcel be?
- a) 12° C
 - b) 24° C
 - c) 8° C
 - d) 28° C
 - e) None of the above
9. In the upper-levels of the atmosphere, given a constant pressure gradient force, the wind will tend to _____ to the east of a trough of low pressure causing the air to _____ in this area.
- a) Speed up; sink
 - b) Slow down; sink
 - c) Speed up; rise
 - d) Slow down; rise
10. Adiabatic means _____.
- a) Heat is exchanged with the surrounding environment
 - b) There is turbulent mixing of air masses
 - c) Density decreases with height.
 - d) Air is conditionally unstable.
 - e) None of the above.
11. Cloud drops can grow rapidly into raindrops mainly because _____.
- a) The curvature of cloud drops enhances the condensation process.
 - b) Cloud condensation nuclei allow cloud drops to form as soon as saturation is reached.
 - c) Cloud drops of differing sizes collide and coalesce with each other
 - d) All of the above
 - e) None of the above
12. The atmosphere would be conditionally unstable if the environmental lapse rate, or rate of temperature decrease with height is _____ degrees Celsius per kilometer.
- a) 3
 - b) 5
 - c) 8
 - d) 11
 - e) Any of the above
13. Which type of fog forms over the coastal regions of the Pacific Ocean?
- a) Radiation fog
 - b) Advection fog
 - c) Upslope fog
 - d) Evaporation fog
 - e) None of the above.

VERSION A

14. The atmosphere will become more unstable if the surface temperature _____ and the temperature aloft in the atmosphere _____.
- Decreases; decreases
 - Decreases; increases
 - Increases; decreases
 - Increases; increases
15. Which cloud type would indicate the most unstable atmosphere?
- Cirrostratus
 - Cumulonimbus.
 - Nimbostratus.
 - Altostratus
 - None of the above. All of the above cloud types occur in a stable atmosphere.
16. The final state of a wind where the pressure gradient force and the Coriolis force are balancing each other is called what?
- Cyclostrophic wind
 - Hydrostatic wind
 - Geostrophic wind
 - Gradient wind
 - None of the above
17. If you are flying in a jet airplane, the strongest turbulence would be experienced if you flew through which type of cloud?
- Cumulus castellanus
 - Nimbostratus
 - Cumulonimbus
 - Stratocumulus
 - Equally strong turbulence could be expected when flying through all these types of clouds.
18. What is the type of force balance that governs the wind in a tornado?
- Geostrophic
 - Gradient
 - Gradient with friction
 - Cyclostrophic
 - Hydrostatic
19. The Coriolis force is
- Strongest at the equator
 - Important for smaller scale motion
 - Caused by the rotation of the Earth
 - All of the above.
 - None of the above.
20. Aside of extreme heat, what is the most dangerous severe weather hazard in the state of Arizona?
- Hail
 - Flash flooding
 - Tornadoes
 - Dust storms, or haboobs
 - Dust devils

VERSION A

21. Which of the following mechanisms lift air and promote cloud formation?
- a) Orographic lifting
 - b) Frontal lifting
 - c) Convergence
 - d) Localized convective lifting due to buoyancy
 - e) All of the above.
22. Which of these U.S. states has the greatest occurrence of strong tornadoes?
- a) Washington
 - b) Arizona
 - c) New York
 - d) Kansas
 - e) The occurrence of strong tornadoes is about the same in all of these states.
23. If the upper-level winds are relatively light, the wind on the side of a mountain will usually be _____ during the day and _____ at night.
- a) downslope; upslope
 - b) downslope; downslope
 - c) upslope; upslope
 - d) upslope; downslope
 - e) None of the above.
24. Where are most desert regions of the world found?
- a) At the equator
 - b) In the tropics
 - c) In the subtropics
 - d) In the mid-latitudes
 - e) Deserts are equally likely to be found in all of the above places
25. A layer of the atmosphere where temperature increases with height is:
- a) Stable
 - b) Unstable
 - c) Conditionally unstable
 - d) None of the above

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**Midterm Examination #2
NATS 101, Section 13, Fall 2010
Introduction to Weather and Climate
Short Answer Section**

Scoring: Each question is worth points as indicated.

26. Why do monsoon thunderstorms in Arizona typically form over the mountains during the afternoon? Why do thunderstorm clouds always have flat bases and the most intense thunderstorms have flat anvil tops? (**5 points**)

VERSION A

27. Describe how hail forms. How is this process similar or different from the formation of other forms of frozen precipitation, like freezing rain, sleet, and snow? **(5 points)**

VERSION A

28. Explain the difference between thermal turbulence and mechanical turbulence. Give at least one of example of where each would be encountered in the atmosphere. **(5 points)**

VERSION A

BONUS QUESTION: Describe the cloud in the bottle experiment, as shown in class lecture. Physically explain the reason(s) for the cloud formation in this experiment. (**5 Points Extra Credit**)

BONUS QUESTION #2: Name the two countries to which Professor Castro recently traveled to give talks on the subject of climate change. (**2 Points Extra Credit**)

VERSION A